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BUILDING THE HUMAN MACHINE
THE COST OF FOOD

The special conditions surrounding the issue of the January STATISTICAL BULLETIN necessitated a brief interruption in our series of articles on the Value of a Man. In resuming these discussions, we now come to that item in the estimate of the "cost of installation" of the human machine, which the engineer, in his specifications for a cost account, would describe under the heading "materials of construction." Now the human machine is peculiar in that its substance, its material of construction, is essentially the same as the fuel, the food which it regularly consumes. We shall not, therefore, here attempt any separate accounting of the two divisions in the item "materials of construction," namely, whether used for body building or for current maintenance, but shall merely count the cost, *in toto*, of the food that must be provided throughout the non-productive period of early life, up to the eighteenth year of age.

Here, as in certain items previously considered, much depends on the family in which the young citizen is born and bred. The cost varies greatly according to the economic and social status of the parents. Our chief interest here is in the family of moderate or average circumstances. In the budget of such a family the largest single item of expenditure is just this item of food. And since family bookkeeping has not reached that stage of perfection which should enable us to read directly out of the accounts the sum expended on each member of the family, and, in particular, on the growing child, we must seek somehow to extract from the aggregate figure that particular part which is pertinent to our inquiry.

Here the studies of Professor W. F. OGBURN* come to our assistance in our efforts to form at least a rough estimate of the proportion

*OGBURN, WILLIAM F.: The Financial Cost of Rearing a Child: Standards of Child Welfare: United States Children's Bureau: Bureau Publication No. 60: 1919: pages 26–30.

of the family expenditure that may reasonably be charged against each member, and, in particular, against each child of a given age. OGBURN adopts as a basis for his computation a scale of relative food consumption for persons of different ages which has been prepared by the Bureau of Labor Statistics. The standard unit is the average consumption by an adult male, and the scale is as follows:

Relative Food Consumption, by Sex and Age

AGE	MALES ADULT MALE UNITS (*per year*)	FEMALES ADULT MALE UNITS (*per year*)
0– 3	0.15	0.15
4– 6	0.40	0.40
7–10	0.75	0.75
11–14	0.90	0.90
Over 14	1.00	0.90

On this scale, for example, a family of three children aged 3, 8 and 12, respectively, add up, together with father and mother, to 3.7 adult male units. Now according to a formula given by OGBURN, a family so composed spends on an average about 31 per cent. of its income on food. The formula is intended to apply principally to small incomes, say up to $2,000 per annum. We may take it that it still gives an approximately correct indication for a family with an annual expenditure of $2,500, which we have here made the basis of our study. We thus find that the annual expenditure for food is 31 per cent. of $2,500, or a total of $775 per annum. This gives a cost, per adult male unit, of $\frac{\$775}{3.7}=\$210$ per annum. Let us use this figure as a basis on which to compute the total expenditures for food in raising a child from birth to the age of 18 years. In the first four years of life, according to the table above, the child represents 0.15 adult male units, and thus consumes a total of $4 \times 0.15=0.60$ units of food. In the next three years it consumes $3 \times 0.40=1.20$ units; in the next four years $4 \times 0.75=3.00$; in the next four years $4 \times 0.90=3.60$, and lastly, in the three-year period from age 15 to 18, it consumes $3 \times 1.00=3.00$ units in the case of a boy, or 2.70 units in the case of a girl. This gives a total of *11.4 adult-male-per-year units* for a boy. These units, as we saw, represent an outlay of $210 each, thus making a total of $2,394 or, say, in round numbers, $2,400. For a girl the figure is slightly less,

namely, $2,330. This is the cost of the food item alone in the building up of the human individual from birth to age 18, at which the period of self-support may be said to begin.

This is the economic aspect of the matter. Biologically, in balancing the account, we must reckon with the physical requirements of the human body. Dietary studies show that an adult male requires on an average about 3,500 calories per day in the food purchased, which allows about 300 calories for waste in cooking, serving, etc. In the course of a year the requirement in calories purchased, per adult male is, accordingly, 3,500 x 365 = 1,278,000 calories. The cost of these, as figured above, is $210, corresponding to a cost per 100 calories of about 1.64 cents. This accords with average market prices applicable to a family of the class considered.

It should be remarked that a somewhat different age scale of food consumption has been given by Dr. PEARL* who also gives a higher consumption of food per adult male unit. Making some allowance for this alternative estimate, we may round off our estimate upward, and say that on an average, in a family of about five persons (inclusive of father and mother) with a total annual expenditure of $2,500, the total cost of feeding a child from birth to the eighteenth birthday is about equal to one year's total expenditure of the family as a whole.

It seems hardly necessary to point out here once again that we are discussing merely those items in the estimate of the value of a man that are capable of concrete measure; it is not from lack of sense of proportion that sentiment is wholly omitted from reckoning, but from realization of the fact that book can be kept only of material items.

In our current studies of the value of a man there remain to be considered several other items of routine expenditure during the formative period of the human individual—shelter, clothing, health and recreation, and education. These will be discussed in forthcoming issues; after which we shall have to study the economics of the productive years of life, where items appear both on the debit and also on the credit side of the account.

INOCULATION AGAINST TYPHOID FEVER

Inoculation against typhoid fever with typhoid vaccine has become, during the past twenty-five years, one of the most effective means of combating the disease. Remarkable results in reducing

*PEARL, RAYMOND, The Nation's Food; W. B. Saunders Co., 1920, p. 245.

typhoid morbidity and mortality have been obtained through its use. Consequently, the practice of inoculation is increasing. Inoculation, nevertheless, is not an absolute safeguard against contracting the disease. Even during the period for which the protection gained is at its height, heavy infection may induce typhoid fever in a person who has received the best inoculation available. But the chance that such a person will contract the disease from light infection is very small. Obviously, inoculation cannot be regarded as a substitute for sanitary measures which break the channels through which typhoid fever is conveyed. But its value, when used in addition to sanitary precautions, is indisputable.

Speedy and striking results in reducing an epidemic of typhoid fever, or in preventing its spread, when not epidemic, have been obtained when it was possible to inoculate all the persons of a community. Such results have been observed for soldiers and sailors, for whom the inoculation was compulsory, and for some groups in civil life for whom it was possible to enforce compulsory inoculation. The first extensive use of inoculation was among soldiers, and, because of the favorable experience in military life, the practice was adopted in civil life.

Inoculation against typhoid fever was introduced in the United States Army as a voluntary measure in 1909, and was made compulsory in 1911. Immediately thereafter, a marked decrease in the rates for cases and deaths occurred as shown in the table on the next page. The high rates shown for the year 1898 and the years immediately following, were due to the extremely bad conditions during the Spanish American War. After the war, there was a marked improvement in Army sanitary conditions, and its influence is shown in the decrease of the rates. Most of the necessary improvement was accomplished by the time that inoculation was introduced and although improvements in the sanitary conditions of the Army have been made in recent years they have not been marked. It should be noted, therefore, that during the encampment on the Mexican Border and the World War, 1916-1918, years during which marked sanitary improvements were not made, the typhoid fever rates were lower than the rates between the close of the Spanish American War and the introduction of inoculation, even though these years were years of peace. This great improvement in the typhoid fever rates during the World War, as compared with the rates during the Civil War and the Spanish American War, may be attributed largely to the benefits of inoculation.

Typhoid Fever Cases and Deaths per 100,000 Mean Annual Strength, and Deaths per 1,000 Cases. United States Army, American and Native, at Home and Abroad, and United States Navy and Marine Corps

YEAR	UNITED STATES ARMY			UNITED STATES NAVY AND MARINE CORPS		
	Admission Rate per 100,000	Deathrate per 100,000	Deaths per 1,000 Cases	Admission Rate per 100,000	Deathrate per 100,000	Deaths per 1,000 Cases
1923	.....	.....	.....	12.0	1.7	142.9
1922	1.4	.....	.....	9.8	1.6	166.7
1921	5.3	.5	90.9	10.7	.7	62.5
1920	6.8	.5	71.4	24.9	5.0	200.0
1919	55.0	7.6	119.3	16.4	.7	40.8
1918	34.7	5.5	158.9	16.5	1.8	108.4
1917	46.7	3.4	72.6	35.0	.4	11.6
1916	281.2	5.1	17.8	30.3	.....	.....
1915	16.4	.....	.....	33.8	1.5	43.5
1914	18.5	3.1	166.7	29.8	.....	.....
1913	11.2	.....	.....	34.9	6.1	173.9
1912	35.0	4.5	129.0	92.1	3.2	35.1
1911	87.0	9.7	111.1	361.6	24.4	67.6
1910	246.8	17.2	69.7	328.8	17.0	51.8
1909	342.5	26.2	76.4	330.6	29.7	89.9
1908	320.0	32.1	100.4	332.6	18.9	56.8
1907	379.1	30.4	80.2	537.4	36.7	68.3
1906	572.4	27.6	52.0	540.8	32.9	60.9
1905	313.6	30.4	97.0	416.3	24.2	58.1
1904	450.1	34.2	78.5	478.4	46.8	97.9
1903	511.5	44.4	86.2	504.7	34.9	69.1
1902	699.4	85.4	122.1	400.1	41.6	104.0
1901	640.9	84.3	131.3	390.7	52.1	133.3
1900	974.2	163.4	167.7	736.7	105.2	142.9
1899	2069.2	244.4	118.1	643.6	52.8	82.1
1898	14158.8	1483.8	104.8	454.4	45.9	100.9
1897	625.6	31.5	53.0	330.5	25.4	76.9
1896	587.2	63.7	108.1	394.5	63.4	160.7
1895	428.5	47.6	111.1	204.7	45.5	222.2
1894	606.9	70.9	116.9	423.3	31.9	75.5
1893	640.6	63.3	99.4	388.1	33.0	85.1
1892	595.0	49.6	83.3	399.2	59.4	148.9
1891	395.4	43.0	108.7	321.7	43.5	135.1
1890	524.6	49.5	94.5	348.4	8.5	24.4
1889	531.8	56.0	105.3	356.5	53.5	150.0
1888	327.6	48.5	148.4	331.5	30.1	90.9
1887	729.8	71.3	97.7	249.5	.....	.....
1886	394.5	93.3	236.6	*	*	*
1885	314.7	37.3	118.4	*	*	*
1884	649.1	141.5	217.9	*	*	*
*	.....	.....	.....	.....	.....	.....
1865†	1324.7	748.8	605.7	*	*	*
1864†	1768.9	875.8	545.6	*	*	*
1863†	3415.8	1130.5	356.8	*	*	*
1862†	6622.6	1964.6	316.6	*	*	*

*Data for period 1866–1883 not available for the Army; nor 1862 to 1886 for the Navy.

†Mean strength used for computing admission rate per 100,000 does not include mean strength in general hospitals.

The statistics have been compiled from the annual reports of the Surgeons General of the Army and Navy. The Army statistics include officers and troops and both native and American forces, wherever stationed, at home or abroad. Statistics for the years 1866-1883 inclusive are not available. Statistics for the period prior to July 1, 1863, do not include colored troops. Because of the small number of such troops in service before that date, the accuracy of the statistics is but slightly impaired by the omission.

The decline in the typhoid rates for the United States Navy and Marine Corps following inoculation, has been almost as marked as for the Army. During the year 1912, anti-typhoid inoculation was strongly recommended to officers and men in the Navy but was not compulsory. At the end of the year, the inoculation became compulsory and was completed during the year 1913. The marked decline in the typhoid rates which began at this time was largely due to the compulsory inoculation.

The marked increase in typhoid fever during the World War which occurred in the Army is not found in the statistics for the Navy. It may be assumed that the typhoid risks caused by the war, due to massing of troops in the field, were incurred to only a slight extent by the naval and marine forces. In the Army, the increase of typhoid fever among the troops abroad was more marked than among the troops in the United States. The large number of men from the Marine Corps who fought in France, was, after all, but a small proportion of the total strength of the Navy and Marine Corps; and the number of men in the Navy who saw land duty was, relatively, extremely small.

SEVENTY-NINE MILLIONS PAID IN DEATH CLAIMS TO METROPOLITAN BENEFICIARIES DURING 1925

Beneficiaries of Metropolitan policyholders whose death claims were paid during 1925 received the sum of $78,934,833 in settlement of these obligations. The amounts paid on account of deaths from the principal causes are shown in the table on page 7 of this BULLETIN.

Diseases of the heart were responsible for larger claim disbursements than for any other cause. This is the second successive year in which the amount paid for deaths from cardiac disease has exceeded that for tuberculosis, which, up to and including 1923, was the leading cause of death from the standpoint of death claim disbursements. Heart disease, cerebral hemorrhage and chronic nephritis are the three principal cardiovascular-renal conditions. Together,

death claim payments on account of these diseases amounted to $20,672,009 or 26.2 per cent. of the total sum disbursed. This high ratio is likely to increase from year to year. These diseases are not as amenable to control as are those conditions whose deathrates have been lowered through time-tried lines of attack—more particularly, the infectious conditions.

The amount paid out on account of tuberculosis was $8,586,815 or approximately one-ninth the total amount paid to beneficiaries

Amounts Disbursed on Account of Deaths from Specified Diseases and Conditions—Entire Experience of Metropolitan Life Insurance Company, Premium-paying Business, 1925

Disease or Condition	Amount*	Per Cent. of Total	
		1925	1924
All Causes of Death	$76,929,728	100.0	100.0
Typhoid fever	541,205	.7	.7
Influenza and pneumonia	7,620,933	9.9	9.5
Influenza	1,782,207	2.3	1.7
Pneumonia—all forms	5,838,726	7.6	7.7
Tuberculosis—all forms	8,586,815	11.2	12.3
Tuberculosis of respiratory system	7,882,597	10.2	11.4
Cancer—all forms	7,308,177	9.5	9.4
Cerebral hemorrhage—apoplexy	4,387,192	5.7	6.6
Diseases of the heart	10,394,057	13.5	13.5
Chronic nephritis	5,890,760	7.7	7.0
Puerperal state	1,232,336	1.6	1.7
Total external causes	9,450,941	12.3	12.3
Suicides	1,527,758	2.0	2.1
Homicides	847,618	1.1	1.2
Accidents	7,073,675	9.2	9.0
Accidental drowning	694,147	.9	.9
Traumatism by fall	788,783	1.0	1.1
Railroad accidents	734,340	1.0	.9
Automobile accidents	1,819,958	2.4	1.9
Other accidents	3,036,447	3.9	4.2
All other causes of death	21,517,312	28.0	26.9

*Total death claim disbursements, $78,934,832.77. Above tabulation does not include death claims on "Paid-up" or automatic term extension business.

in death claims. In 1924, the amount disbursed in tuberculosis claims amounted to one-eighth of the total. Thus, the marked decline in the tuberculosis deathrate which took place in 1925 is reflected in a smaller ratio to the sum paid out in all death claims.

Deaths from influenza and pneumonia, combined, were responsible for claim payments in the sum of $7,620,933 or a little less than

one-tenth of the total amount. This is approximately the same proportion as obtained in 1924.

Enormous sums of money continue to be disbursed every year by insurance companies on account of cancer. In 1925 the Metropolitan paid out only a little less for cancer than for influenza and pneumonia combined. The cancer deathrate, in the industrial population, has been practically stationary for the last five years. The per cent. of the total, paid out on account of this disease, was 9.5.

About one-eighth of the total death claim payments was to beneficiaries of policyholders who died from violence—either accident, suicide or homicide. For accidental deaths alone, more than $7,000,000 were disbursed or approximately one-eleventh of the total. Of the $7,000,000, more than $1,800,000, or a little over one-fourth was paid on account of automobile accidents. These fatalities necessitated disbursements of approximately two and one-half times as much money as either railroad accidents, drownings or accidental falls.

More than $1,500,000 was disbursed on account of suicides. This sum constituted approximately one-sixth of the money paid out on account of the mortality from all violent deaths. Payments on account of homicides increased from $773,000 in 1924 to $848,000 in 1925.

HEALTH RECORD FOR JANUARY, 1926

Health conditions in the Industrial populations of the United States and Canada were not quite so favorable in January as during the same month of last year. This is indicated by the slight rise in the deathrate from 9.7 per 1,000 in January, 1925, to 9.8 in 1926 among 17,000,000 Industrial policyholders. Neither of these rates, however, are high for this time of the year. They may be compared with 10.0, in 1924; 10.7, in 1923; 9.7, in 1922 and 1921; and 10.4, in 1920. The expected seasonal increase in the mortality, as compared with December, was reported.

The slight rise as compared with January of last year was due very largely to an eight per cent. increase in the deathrate for pneumonia. Smaller increases were recorded for influenza, Bright's disease, suicides, homicides, and automobile accidents.

There was also a very considerable increase in the mortality from measles, the rate rising from 2.3 per 100,000 in January, 1925, to 9.5 in the same month of 1926. As we noted in the January STATISTICAL BULLETIN, the deathrate for this disease appears to

run, largely, in cycles; and the relatively high mortality in January may well presage a "measles year" in 1926.

It is most discouraging to record the fact that still another year has opened unfavorably with respect to automobile fatalities. The deathrate for this cause for January was 13.6 per 100,000, and the actual number of deaths was 200. This marks an increase of 21.4 per cent. over the figure for January, 1925, (11.2) during which month 151 Industrial policyholders lost their lives in motor vehicle accidents.

The general deathrate for the large cities of the United States in January was 14.9 per 1,000, or slightly above the rate for January, 1925, (14.4). A large increase over the figure for December, 1925 (12.7), was recorded. There was increased prevalence in January, as compared with the same month a year ago, of influenza, malaria, measles, poliomyelitis, scarlet fever, and whooping cough, with fewer cases of diphtheria, smallpox, and typhoid fever. Comparison with December, 1925, shows more sickness from influenza, measles, scarlet fever, smallpox, and whooping cough, with fewer cases of diphtheria, malaria, poliomyelitis, and typhoid fever.

Diphtheria declined quite generally throughout the country. This disease was reported early in the month to be prevalent to an alarming degree in some sections of Sandusky, Ohio.

Measles, in January, was by far the most prevalent of the communicable diseases. The greatest increases in case reports, as compared with December, were reported from Colorado, Illinois, Indiana, Maryland, Massachusetts, Michigan, New Jersey, and New York. In Indiana, 1,022 cases were reported as compared with 57 in December; in Colorado the increase was from 623 cases to 2,095; and in Michigan, from 801 to 3,692. In Ohio, 10,332 cases of measles were reported as compared with 390 cases during January, 1925. Approximately one-fourth of the Ohio cases were reported from the City of Cleveland. The disease was also very prevalent in Baltimore, Md., where the Commissioner of Health referred to conditions as "epidemic in proportion." Earlier in the month, new cases were averaging 50 daily in Winnipeg, Manitoba. The disease was quite generally epidemic throughout the southern part of Saskatchewan.

Scarlet fever was more than usually prevalent in Michigan and New Jersey, cases increasing in the former State from 1,155 in December, to 1,409 in January, and in New Jersey, from 579 to 870. There were outstanding outbreaks of the disease in Groveland and Batavia, N. Y. The disease has also been epidemic in Hamilton, Ontario, with new cases averaging about ten a day.

Influenza showed increases in nearly all the States, more especially in Arkansas and Maryland. More than 50 of the 1,000 soldiers stationed at Fort Myer, Va., were reported confined to the Post Hospital with influenza, and still others were suffering from a milder form of the disease.

Smallpox increased in January, especially in North Carolina, Michigan, Iowa and California. In North Carolina, there were 107 case reports in January as compared to 42 in December; the corresponding figures for Michigan were 119 and 34. An outbreak in Los Angeles was reported by the city health officer as causing "some little worry." Cases under observation were about 20 per cent. more virulent than the types prevailing during the last few years. Smallpox was present in several Florida cities and newspaper reports are to the effect that about 2,000 persons were vaccinated daily in Tampa. Elgin, Ill., reported an outbreak of 12 cases in one week. Smallpox has also been prevalent in several parts of Oregon. There were also a number of cases among employees of the Canadian National Railway at Moose Jaw, Saskatchewan, and the disease reached epidemic prevalence in the district around Atikokan, Northern Ontario.

Among the outstanding public health activities of the month, the following may be mentioned. A series of clinics for the treatment of children of preschool age with diphtheria toxin-antitoxin, is being planned by the health officer of Olean, N. Y. At Harrisburg, Pa., a health council has been formed to coordinate the health work of the city and bring into closer cooperation various health agencies. Meetings will be held bi-monthly and one of the first objectives will be to secure a hospital for contagious diseases.

The following table shows the mortality among the Industrial policyholders for January, 1926; January, 1925; December, 1925; and the year 1925.

METROPOLITAN LIFE INSURANCE COMPANY

Deathrates* per 100,000 for Principal Causes, Premium-paying Business in Industrial Department (Annual Basis)

MONTHS OF DECEMBER, 1925; JANUARY, 1926, AND OF JANUARY, 1925

CAUSES OF DEATH	RATE PER 100,000 LIVES EXPOSED*			
	Jan., 1926	Dec., 1925	Jan., 1925	Year 1925†
TOTAL—ALL CAUSES	981.2	893.9	970.9	906.9
Typhoid fever	3.9	4.4	4.4	4.6
Measles	9.5	4.4	2.3	3.3
Scarlet fever	4.0	3.2	5.2	3.5
Whooping cough	6.6	4.3	5.2	7.7
Diphtheria	11.2	11.3	16.1	10.6
Influenza	27.1	16.8	25.6	21.9
Tuberculosis (all forms)	91.0	90.2	97.9	98.0
Tuberculosis of resp'y system	81.4	81.4	86.4	85.8
Cancer	69.7	72.1	72.0	70.5
Diabetes mellitus	17.6	16.4	19.5	15.2
Cerebral hemorrhage	60.0	55.1	59.6	53.5
Organic diseases of heart	147.0	133.2	145.9	126.6
Pneumonia (all forms)	138.0	101.4	127.8	86.5
Other respiratory diseases	15.9	15.6	17.1	13.3
Diarrhea and enteritis	17.0	19.3	17.3	36.6
Bright's disease (chronic nephritis)	74.8	72.5	71.7	69.8
Puerperal state	14.3	13.1	14.7	16.5
Suicides	7.5	6.1	5.8	6.9
Homicides	7.2	6.6	6.7	7.2
Other external causes (excluding suicides and homicides)	59.2	54.7	60.3	64.2
Traumatism by automobiles	13.6	15.3	11.2	16.5
All other causes	199.6	193.2	195.7	190.5

*All figures include infants insured under one year of age.
†Based on provisional estimate of lives exposed to risk in 1925.

Correspondence on the subjects discussed in these BULLETINS may be addressed to: The Editor.

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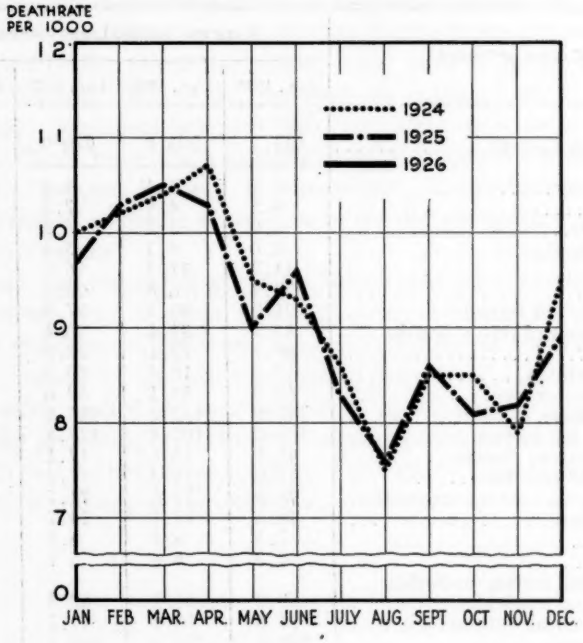
DEATHRATE PER 1000
in SPECIFIED MONTHS of
1924, 1925, 1926

METROPOLITAN LIFE INSURANCE COMPANY
INDUSTRIAL DEPARTMENT
(ANNUAL BASIS)



	1924	1925	1926		1924	1925	1926
JAN.	10.0	9.7	9.8	JULY	8.6	8.3	
FEB.	10.2	10.3		AUG.	7.5	7.6	
MAR.	10.4	10.5		SEPT.	8.5	8.6	
APR.	10.7	10.3		OCT.	8.5	8.1	
MAY	9.5	9.0		NOV.	7.9	8.2	
JUNE	9.3	9.6		DEC.	9.5	8.9	

NOTE: Figures include mortality of infants under one year of age.

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